Evaluation of ASTER Data for Geologic Mapping in Semi-Arid Terrain

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Abstract*

Since 1982, Landsat Thematic Mapper (TM) data have proven to be an effective tool for geologic mapping and assessment where rocks are well exposed, as they typically are in semi-arid terrain. For the next 5 years, the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER), one of five primary Earth remote sensing instruments onboard NASA's recently launched Terra spacecraft, will acquire data that should take us to the next level in terms of the efficiency and effectiveness with which we apply satellite land remotely sensed data to the study of geologic conditions and processes.

ASTER data offer three major capability enhancements for geologic studies as compared to TM data and as compared even to data from the recently launched Enhanced Thematic Mapper Plus (ETM+). First, ASTER has six spectral bands in the 1.5 μm to 2.4 μm region of the electromagnetic spectrum compared with two bands for TM and ETM+. These additional bands hold great potential for improving the ability to discriminate and identify hydroxyl-bearing and carbonate minerals, among others, which should advance significantly the detail with which were are able to detect and map lithologic variation, including hydrothermal alteration. Secondly, ASTER has five spectral bands in the thermal infrared (TIR) portion of the spectrum, compared with one for TM and ETM+. Not only will these bands be extremely useful for determining temperature and emissivity characteristics of rocks and other surface materials, they should improve greatly our ability to differentiate and map high-silica-bearing rocks, particularly. The third important attribute of ASTER for geologic and other land studies is its along-track stereo imaging capability. Not only will these data provide means to generate useful-resolution digital elevation models (DEMs) where none currently exit; they will benefit geologic investigations by providing topographic information for data correction and enhanced display of image data and products.

This paper examines and evaluates these ASTER data attributes, particularly the spectral improvements, in the context of geologic information extraction and mapping in semi-arid terrain. ASTER data from test sites, such as the Drum Mountains, Utah; Death Valley, California; or Goldfield, Nevada, where previous remote sensing studies have similarly evaluated capabilities of existing satellite and airborne sensors will be used. Results will be evaluated specifically in comparison to Landsat 7 ETM+ data.